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Computer Ethics: Job of Computer Scientist

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Abstract: ***This paper reiterates the fact that computer ethics is a job of computer scientist and not philosophers. This paper is divided into three sections. First section provides with a brief explanation and discussion on the weaknesses and shortcomings of classical ethical theories like Divine command theories, Ethical Egoism, Kantianism, Utilitarianism, Social Contract Theory and Virtue Ethics, which makes them unfit for the application of computer ethics. Second section discusses the ambiguity in theories proposed for foundation of computer ethics. Third section deals with professional ethics and discusses that Computer ethics is a domain of computer scientist. This article gives a clear picture of shortcoming of traditional ethical theories and need of new theory to deal with computer ethics. This article points out flaws in theories trying to give foundation for computer ethics. We suggest professional ethics as practical and preventive measure for computer ethics that caters to its requirements. We also explores the role of computer scientist for the application of computer ethics as a profession.***

Keywords: Computer ethics; computer scientist; professional ethics; foundational ambiguity; code of ethics.

I. INTRODUCTION

Modern day societies are driven by computing technologies and are critically dependent on it. Every aspect of society like health, finance, defense, education, transportation and an unending list of other systems which drive our society are dealing with computing technology and artefacts. This merger of technology and society has given rise to tremendous ethical issues. The computer professional who built these artefacts need not only to have a technical expertise to build these artefacts, but also has to keep social implications of these artifacts into consideration. Social implications demand a moral framework to deal with the ethical issues of computing technology. Computer ethics has progressed over 70 years, evolved from numerous perspectives and still changing and evolving. This article explores these perspectives and is divided into three sections. First section discusses and rejects the perspective that traditional ethical theories suffice computer ethics and thus computer ethics is not a discipline in its own rite. Second sections discusses the ambiguity in foundational theories of computer ethics which tries to give conceptual framework for computer ethics. Third section discusses professional ethics as a preventive measure for computer ethics and reiterates the fact that computer ethics is a job of computer scientist.

This article provides a clear understanding that traditional ethical theories and foundational computer ethics theories both fail to give conceptual framework for computer ethics and thus professional ethics is a practical and preventive measure for computer ethics.

II. TRADITIONAL ETHICAL THEORIES AND COMPUTERT ETHICS

Morality is a lot like nutrition. We cannot avoid confronting moral problems because acting in ways that affect the well-being of ourselves and others is as unavoidable as acting in ways that affect our physical health. We inevitably face choices that hurt or help other people; these choices may infringe on their rights, violate their dignity, or use them as mere tools to our own ends. We may choose not to pay attention to the concerns of morality such as compassion, justice, or respect, just as we may choose to ignore the concerns of nutrition. However, that does not mean we can avoid making decisions about morality any more than we can evade deciding what foods to eat. We can ignore morality, but we cannot sidestep the choices to which morality is relevant, just as we cannot avoid the decisions to which nutrition is pertinent even when we ignore the information that nutritionists provide. Morality is about living, and as long as we continue living, we will inevitably be confronted with moral questions—and if we choose to stop living, that too is a moral issue.[1]

The classical theories which are bases for moral or ethical decisions and their shortcomings are discussed as:

Divine command theories

Divine Command Theory states that God's commands are what is considered to be good. God's commands are taken from holy books like the Bible, the Qur'an, the Vedas or other sacred texts. These texts specify what is right and what is wrong [2]. Divine Command Theory offers metaphysical foundation for morality. As a Normative theory, Divine command theory states that actions are right when they follow to God's will or respond to his commands. Divine command theory argues that the foundation of morality is God's will [3]. Immanuel Kant, in his Critique of Practical Reason, asserts that God and an afterlife are basis of morality. Immanuel Kant further suggested that we can't endure morality and we need to believe in God for satisfying the demand of morality[3].

Divine command theory provides a basis for being moral, it makes us accountable for our actions. All religions have common core values which can be applied for computer ethics, like all sacred texts prohibit from stealing, so one can apply this to prohibit piracy. Divine command theory has many problems which makes it unfit for computer ethics:

1. The Euthyphro Dilemma:

The 'Euthyphro dilemma' originates from Plato's dialogue in which Socrates asks: "Is something is right because God commands it, or does God command it because it is right?" There are two parts in the question and both parts seems unsatisfactory and contradicting with each other, thus creating a logical dilemma. Let us analyze these two cases:

(a) If something is moral whatever God commands, then if God commands what is morally wrong, then what is wrong will become right - if God commands us to steal, then stealing would be morally right. This makes God's commands trivial and arbitrary.

(b) If morality is external to God's will , then God commands something because it is right- stealing is morally wrong whatever God commands. This removes arbitration problems of first option but creates another problem that right and wrong is external to God and it does not matter what God Commands[4].

2. Disagreement between sacred Texts :

There are many religions with many sacred books and there is a stark contradiction between these texts. It will be naïve to assume that everybody will get on board to believe in one particular Text. There are even multiple Texts or multiple versions of holy Texts and also multiple interpretations of a single texts available which make Divine command theory as highly unsuitable for computer ethics[5:63].

3. Analogy as a tool :

The issues of computer ethics are not directly written in sacred Texts, they need to be derived using analogy. For example moral problems like piracy, internet privacy etc. are not directly referred in Quran or Bible but need to be derived using analogy. This analogy is dependent on the interpretation of that person who makes that analogy[5:64].

4. Impractical for multiethnic society :

Our society is a blend of different ethnicity, faiths and culture. To impose religion based ethics will be unrealistic. Even there are people who are atheist, so imposing Divine command theory for computer ethics will simply create chaos than solution[5:63].

Ethical Egoism

Ayn Rand in her book, The Virtue of Selfishness eulogized selfishness as a virtue.

Ethics is not a mystic fantasy—nor a social convention —nor a dispensable, subjective luxury. ... Ethics is an objective necessity of man's survival —not by the grace of the supernatural nor of your neighbors nor of your whims, but by the grace of reality and the nature of life.

The Objectivist ethics proudly advocates and upholds rational selfishness —which means: the values required for man's survival qua man—which means: the values required for human survival—not the values produced by the desires, the feelings, the whims or the needs of irrational brutes, who have never outgrown the primordial practice of human sacrifices.[6]

Ethical egoism is in sharp contrast to the divine command theory, which encourages care and love for others by virtue of its scriptures[5]. Ethical Egoism is a normative theory, where each person ought to do whatever will best uphold his or her own interests. Ethical egoism, states that each person should seek to maximize self-interest and ought to act selfishly. It is like a consequentialist theory; applied on an individual, as consequences determine rightness and wrongness of an act The ethical egoist extol selfishness and recommends to act in the way that best promotes their own interests[1].

Ethical egoism can't be applied for computer ethics as it will recommend self-interest which may lead to act in conflicting ways. Piracy will be recommended as it will benefit the party who pirate software because no payment is done to acquire that software and thus it would be in their own interests to acquire that software. Software developer on the other hand will be recommended by ethical egoist to get full price. Ethical egoist as per the theory has to ensure for one party to pay full price and for other party not to pay full price, so it is conflicting as well as inconsistent theory to be applied for computer ethics. Ethical egoism if applied for computer ethics may aggravate ethical issues created by computer ethics, thus we reject this theory to be applied for computer ethics.

Kantianism

Kantianism is the name given to the ethical theory of the German philosopher Immanuel Kant (1724–1804). Kant's ethical theory is deontological based on duty. Kant proposed universal laws as a guide for actions. The central entity of his theory is "Categorical imperative" which is sum total of morality and derives all duties and commitments. Kant recognised categorical imperatives as obligatory and sine qua non to follow irrespective of our desires. Kant argued that any action violating categorical imperative is immoral and any action adhering to categorical imperative is moral. Kant proposed "maxim" as our individual principles which guide our decisions, e.g. "to have as much fun as possible", "to marry only someone I truly love". He believed these maxims are same for all and sum total of these maxims is the morality. Kant's theory differs from divine command theory by adding reason to the actions. Divine command theory qualifies any action to be right or wrong on the basis of sacred text, while Kant's theory explains why a particular action is right or wrong[5][7]. Kant proposed three rules to formulate the Categorical Imperative:

1. "Act only according to that maxim whereby you can at the same time will that it should become a universal law[8:30]". That is, one need to act only on that maxim which is pertinent to every set of situations, accepted by all and can become a universal law
2. "Act in such a way that you treat humanity, whether in your own person or in the person of another, always at the same time as an end and never simply as a means[8:36]". Kant emphasized here the inimitable worth of human life, which deserves moral respect and gets human concern into the universal law.
3. "Therefore, every rational being must so act as if he were through his maxim always a legislating member in the universal kingdom of ends[8:46]". This is "formula of autonomy" where Kant positioned everything together and the choice to act what maxim dictates is considered having made it a universal law. Kant further combined the principle of universalizability and concern of human dignity to arrive at a conception of the moral law as self-legislated by each for all[9].

Kantianism is good as a starting point for computer ethics as it suggests logic and reasoning for actions, but its strict duty oriented protocol makes it conflicting and unbefitting for computer ethics. For example,

1. Someone needs money for treatment of his children, so he hacks bank to steal money. In this situation two categorical imperatives regarding stealing and treating kids are going to be in conflict and thus makes Kantianism not appropriate to apply.
2. Hacking into anyone's system is morally wrong but what about hacking system of a criminal who can be a potential terrorist. Kantianism simply recommends to go by categorical imperative: hacking is immoral.

Kant's ethical theories "remains clearly relevant and fruitful for reflection on the aesthetic, ethical, and political dimensions of ICTs, especially as they become increasingly interwoven in the lives of those inhabiting the developed world"[10].The issues of computer ethics are so novel and widespread that Kantianism fails to cater its diversity , so we need "to go beyond Kant revising his epistemology and thus ontology"[10].

Utilitarianism

Utilitarianism is a normative teleological consequentialist ethics theory where consequences determines morality, any act is morally right is determined by exclusively on consequences or the goodness of consequences. Utilitarianism differs sharply from Kantianism which basis morality on motives behind an action. Utilitarianism also differs from ethical egoism which is also a consequentialist theory and is based on consequences which are concerned with individual wellbeing. Utilitarianism deals with consequences which affect everyone under consideration[1:130]. Utilitarianism theory proposes that "An individual act (X) or a social policy (Y) is morally permissible if the consequences that result from (X) or (Y) produce the greatest amount of good for the greatest number of persons affected by the act or policy[11:53]". Utilitarianism has two versions act utilitarianism and rule utilitarianism. Act utilitarianism proposes that "An act, X, is morally permissible if the consequences produced by doing X result in the greatest good for the greatest number of persons affected by Act X[11:55]". Act utilitarianism considers something moral if its net effect produces more happiness than unhappiness. Rule utilitarianism proposes that "An act, X, is morally permissible if the consequences of following the general rule, Y, of which act X is an instance, would bring about the greatest good for the greatest number[11:56]". Rule utilitarianism removes weaknesses of act utilitarianism by including principle of utility as its basis. Rule utilitarianism weighs consequences as per rules. Rule utilitarianism apply rules like Kantianism, but differ in the application of these rules. Kantianism apply rules as per categorical imperatives based on the will encouraging the action. Rule Utilitarianism apply rules which result in greater good and are solely seeking the consequences of the action.

Act utilitarianism is unfit to be applied for computer ethics, consider a scenario:

A team of software developers develop a software after dedicated one year hard work. This software can benefit millions. If this software is given to these million users free of cost by piracy, all these users will be happy and just few developers will be unhappy. Piracy created here greater good for greater number of people, so act utilitarianism will allow piracy as moral act. This illustrates a serious flaw in this theory as by this software development as a profession will cease to exist, so we reject act utilitarianism to be applied for computer ethics.

Rule utilitarianism in above scenario can reject such an act on the basis of following rule: An act that can intentionally harm guiltless individuals is forbidden, even if outcome of such an act may produce greater good. Rule utilitarianism removes flaws of act utilitarianism but still is not feasible to be applied for computer ethics. Rule utilitarianism basis morality in consequences and happiness, so a scale is required to measure positive as well as negative consequences which is not plausible. This can lead to erroneous moral evaluation, so we need to modify rule utilitarianism or find an alternative theory to be applied for computer ethics.

Social Contract Theory

In the era of Enlightenment of 17th and 18th century social contract theory gained impetus to challenge moral and political established fundamentals. Social contract theory led philosophers to drive there thinking past consequence and duty based theories. Social contract theory broadly runs on two pacts "Pactum Unionis" and "Pactum Subjectionis". Pactum Unionis is a pact "where people undertook to respect each other and live in peace and harmony". Pactum Subjectionis is a pact where "people united together and pledged to obey an authority and surrendered the whole or part of their freedom and rights to an authority". Thomas Hobbes, John Locke, and Jean-Jacques Rousseau are three Enlightenment thinkers who worked for founding a standard view of social contract theory. They worked on same concept but with different interpretations. John Rawls later revived the social contract theory by introducing his theory of justice.

Thomas Hobbes inspired from English civil war in his book Leviathan, expressed his fear and chaos without rules and a mechanism to enforce such rules. He describes such rule-less anarchy as "state of nature", where no moral rules exist and everyone act as per their desires to avoid "aversions". This state he described will be full of "continual fear, and danger of violent death," and life without a social moral structure would be "solitary, poor, nasty, brutish, and short"[12]. Hobbes proposed a social structure, which he called social contract in which he suggested that a civilized society need to establish moral rules and all citizens should abide by these rules. Moreover he suggested to establish a government capable for enforcing these rules. He believed to have unquestionable sovereign with absolute power and every individual has to obey. Hobbes further argued that "law is dependent upon the sanction of the sovereign and the Government without sword are but words and of no strength to secure a man at all … Hence, Individualism, materialism, utilitarianism and absolutions are inter-woven in the theory of Hobbes"[13].This concept of absolutism will be evasive to apply for computer ethics.

John Locke worked on same principles of Hobbes social contract theory but argues that sovereignty should reside with people and people should have power to overthrow rouge government which doesn't abide by the law. Locke moved the sovereignty from state to the people in other words he believed in political society where people surrender their natural power in the hands of community and it is the community which upholds law. John Locke recognized both pactum unions and Pactum Subjectionis. These pacts denote the WILL of people under which legitimacy of government can be established[14]. Locke argued that life in the state of nature was good, as nature allowed people to be equal, independent and selfish. He stated that "everyone had a natural right to defend his Life, health, Liberty, or Possessions"[15].We reject application of Locke's theory to computer ethics as it has many flaws. There can be conflicts in law of nature as different people will have different interpretations of these laws, so we need a central entity to interpret and enforce these laws.

Jean-Jacques Rousseau gave new interpretation to social contract theory in his work "The Social Contract".

The problem is to find a form of association which will defend and protect with the whole common force the person and goods of each associate, and in which each, while uniting himself with all, may still obey himself alone, and remain as free as before… There is but one law which, from its nature, needs unanimous consent. This is the social compact; for civil associate is the most voluntary of all acts. Every man being born free and his own master, no one, under any pretext whatsoever, can make any man subject without his consent…[16]

Rousseau like Hobbes and Locke proposed social contract theory. Rousseau argued that "Through Social Contract, a new form of social organisation- the state was formed to assure and guarantee rights, liberties freedom and equality". Rousseau proposed that this social structure has to be as per the "General Will" of people, anything against General Will stays discarded. Rousseau like Locke believed in the sovereignty of people preserved and protected by the state. Rousseau separated sovereignty from state and made state, law and government interchangeable. He could not distinguish between state and government which makes his theory non-pragmatic to implement[17].

John Rawls (1921-2002) gave new dimension to social contract theory by proposing in 1971 "A Theory of Justice". His theory was based on rights and liberties having fairness as its essence rather than moral rules. Rawls put forward two Principles of Justice which would, assure a society ethically adequate and just. First principle states each person in a society should have an equal opportunity to attain basic liberties irrespective of their economic or social status. The Second principle states that social and economic inequalities should be available to everyone equally. Thus second principle also called the difference principle is application of inequalities in economic and social liberties as per first principle.

Social contract theory overall is rational and methodical as it is based on the reasoning. It gives reason for any action to be ethical or unethical. However social contract theory can't be applied for computer ethics owing to its weaknesses. Firstly there is no such contract in real terms, secondly there can be conflicts as per different perceptions of same moral problem and lastly there is immense difficulty to comprehend certain moral problems.

Virtue Ethics

Virtue ethics, is a normative ethical theories proposed by Socrates, Plato, Aristotle, the Epicureans, and the Stoics. It is one of the most significant theory of ethics and differs sharply with Kantianism and consequentialism. The arête or virtue and life driven by virtues appears in Aristotle's book Nicomachean Ethics. Virtue ethics is grounded in character and virtues rather than duty or consequences. According to virtue ethics a person with ideal character traits is a virtuous person and these traits develop through training and repetition. Aristotle claimed moral ability can be acquired when imparted and accustomed within families and communities. Aristotle proposed two virtues: intellectual virtues dealing with reasoning and truth and moral virtues dealing with character. The moral virtues help making our lives go well. Aristotle proposed "doctrine of mean" which settles character trait or virtue in between two extremes of vices: excess, and deficiencies for various virtues. For example, the virtue pleasure lies between two extreme vices recklessness and cowardice. Virtue ethics removes the deficiencies of Kantianism and social contract theory where there can be a conflict. Virtue ethics resolves this weakness as moral wisdom guides a person to take right decision and "virtuous people do the right things at the right times for the right reasons" [5].

Virtue ethics is not a perfect theory for computer ethics. The world we live in is more complicated, it is multicultural and heterogeneous, different societies have different concepts of virtues and different perceptions of character traits. We need to have universally accepted moral principles which will identify unambiguously virtues from any character trait. Virtue ethics deals with a virtuous individual and deems that a person lives in a generally virtuous society with a virtuous government. But there can be conflicts between an individual and the state or the surrounding culture. Virtue ethics if applied for computer ethics will allow inconsistent decision making, as there are no clearly specified rules to justify particular action as moral or immoral[18].

Above discussion clearly makes it obvious that each ethical theories possesses something which can be imparted and applied for computer ethics, but no such theory is perfect and can cover up entirely computer ethics. Computer ethics has established itself as a discipline in its own rite. It is so unique that traditional ethical theories can't cater to the needs of computer ethics. Computer ethics needs a theory which is amalgam of all, it needs to follow duty of Kantianism, include virtues of Virtue Ethics, considers decisions based on consequences of Utilitarian theory. It should also include social contract theory to uphold and guard life, peace, liberty and property.

III. AMBIGUOUS FOUNDATION OF COMPUTER ETHICS

Computer ethics is relatively in its inception, it has observed an immense modifications on many fronts in just more than a half century. Over years computer ethics has developed "from obscure entity to a ubiquitous entity", though it is still young and developing. Computer ethics and issues related to computer ethics are so myriad and dynamic that there is a "conceptual vacuum" and to deal with this we also have a "policy vacuum". There is uncertainty and ambiguity that its meta-philosophical and conceptual foundation keeps reforming in the work of computer scientists, Philosophers, thinkers, and scholars[19]. Tremendous work on conceptualization of computer ethics has been done and we are still searching for a perfect theory. Researchers and thinkers From Professor Wiener to Luciano Floridi have proposed a series of theories to cater the requirements of computer ethics but its foundation is still not clear. Computer ethics has established now as a discipline in its own right and colossal work has been done for its theoretical underpinning. Computer ethics has "moved from problem analysis – primarily aimed at sensitising public opinion, professionals and politicians – to tactical solutions resulting, for example, in the evolution of professional codes of conduct, technical standards, usage regulations, and new legislation"[20]. Floridi et al argued that the bottom up procedure should be replaced by top down procedures which leads to a foundationalist debate, as these bottom up procedures are at "constant risk" for "spreading of ad hoc or casuistic approaches to ethical problems". They believed that foundationalist debate is characterised by "a metatheoretical reflection on the nature and justification of computer ethics and the discussion of 'computer ethics' relations with the broader context of metaethical theories"[20]. Floridi et al argued Computer ethics as a unique discipline and enquired: "Can computer ethics amount to a coherent and cohesive discipline, rather than a more or less heterogeneous and random collection of ICT-related ethical problems, applied analyses and practical solutions? If so, what is its conceptual rationale? And how does it compare with other ethical theories?"[20]. Floridi et al have identified five approaches to map the foundation of computer ethics[20].

The "No resolution" approach: computer-Ethics is Not a real Discipline

According to the "no resolution approach" computer ethics is not a discipline in its own rite and it has no conceptual framework. Floridi refers parker (1981) who considers computer ethics problems representing unsolvable dilemmas and thus computer ethics a pointless exercise because there is no conceptual foundation. Floridi put forward Gotterbarn criticism of Parker, and proposed No resolution as unnecessarily pessimistic. Floridi argued that computer ethics "problems are successfully solved, computer ethics related legislation is approved and enacted" and "professional standards and codes have been promoted"[20]. Floridi argued that no resolution approach prompts the development of the other four approaches as it "Methodologically, provides a useful point of reference because it represents an ideal lowest bound for the foundationalist debate comparable to the role played by relativism in metaethics"[20].

The professional approach: Computer Ethics is a pedagogical methodology

Donald Gotterbarn, In 1990s, to fill the gap of coherent conceptualization of computer ethics and to deal with its myriad issues proposed his professional ethics approach. He believed that computer ethics should inculcate:

Introduce the students to the responsibilities of their profession, articulate the standards and methods used to resolve non-technical ethics questions about their profession, develop some proactive skills to reduce the likelihood of future ethical problems,… indoctrinate the students to a particular set of values… and teach the laws related to a particular profession to avoid malpractice suits.[21]

Gotterbarn argued that computer ethics issues are clouded due to its diversity and there is no clear consensus on its ethical positions. Gotterbarn proposed "The only way to make sense of [Computer Ethics] is to narrow its focus to those actions that are within the horizon of control of the individual MORAL computer professional"[21][22]. He argued to narrow the focus on broader issues will help computer ethics problems get solved[19]. He advocated for professionalism of computing professionals and argued the professional-ethics approach from a position where there is "no deep theoretical difference between computer ethics and other professional ethics like business ethics, medical ethics or engineering ethics"[21][22]. We believe in Gotterbarn theory of professional-ethics approach and its criticism by Floridi and improvements will be discussed shortly.

The radical approach: computer Ethics as a Unique Discipline

The Radical Approach is based on the Moor's policy and conceptual vacuum[23]. Floridi et al referred Maner and Mason, who qualifies computer ethics as unique and advocates new approach to deal with ethical issues created by computer ethics[24][25][26]. Maner claims that:

[Computer ethics] must exist as a field worthy of study in its own right and not because it can provide a useful means to certain socially noble ends. To exist and to endure as a separate field, there must be a unique domain for computer ethics distinct from the domain for moral education, distinct even from the domains of other kinds of professional and applied ethics. Like James Moor, I believe computers are special technology and raise special ethical issues, hence that computer ethics deserves special status[25].

Floridi et al argued that cases mentioned by Maner are not uncontroversial unique and he suggested that Radical Approach would require "explicit and uncontroversial identification of some unique area of study"[20]. Floridi further proposed that computer ethics should not be totally isolated from other macroethical theories as "this would mean missing the opportunity to enrich the ethical discourse"[20].He believed that Ethical issues are interrelated
"Given the interrelatedness of ethical issues and the untenability of the equation "unique topic = unique discipline"[20].

The conservative approach: computer-Ethics as applied Ethics

The conservative approach is based on the claim of Deborah Johnson, who was not satisfied by Maner's claim of uniqueness. She argued that computer ethics is not completely novel and unique. She believed that computer ethics modifies old ethical problems and "give them a new twist." She claimed that "computer ethics is a new specie with its own set of characteristics, different from other species"[19], "but at the same time, the species has generic or fundamental characteristics that are common to all members of the genus"[27]. The Conservative Approach defends traditional macroethical theories – for example Consequentialism, Deontologism, Virtue Ethics, and Contractualism – are proficient of handling Moor's policy vacuum. Floridi et al argued that these theories "might need to be adapted, enriched and extended, but they have all the conceptual resources required to deal with computer ethics questions successfully and satisfactorily"[20]. Floridi et al further argued that "certain ethical issues are transformed by the use of ICT, but they represent only new species of traditional moral issues, to which already available metaethical theories need to, and can successfully, be applied. They are not and cannot be a source of a new, macroethical theory"[20]. Floridi et al reports four problems with this approach:

1. It is controversial that classic macroethics have all the requisite resources to deal effectively and acceptably with computer-ethics problems. It is questionable to apply old ethical theories to the computer-ethics problems which are radically new and unpredictable.
2. Floridi et al points out that Conservative Approach is "metatheoretically undetermined" as it fails to suggest which standard macroethics to apply in cases which are either unique to computer ethics and not found in other domains, or having subtle minor changes. In these case computer ethics "lack of commitment leads to a muddle of syncretic and eclectic positions, often acritical and overlooking the theoretical complexity of the problems involved. [computer ethics]'s lack of an explicit metaethical commitment generates a logical regress: having accepted [computer ethics] as a microethics, one then needs a metatheoretical analysis to evaluate which macroethics is most suitable to deal with [computer ethics] problems"[20].
3. Floridi et al pointed out that conservative approach is "methodologically poor", as it lacks "a clear macroethical commitment". Conservative approach then has to rely upon "common-sense, case-based analysis and analogical reasoning"[20].
4. Floridi et al argued that conservative approach is "metaethically unidirectional", as it answers the question "what can ethics do for computer-ethics", but "fails to ask the philosophically more interesting question", i.e. "is there anything that computer ethics can do for ethics?"[20].

Floridi et al, rejects conservative approach and argued that extending traditional macroethics is not enough to cover computer ethics. They refer to Krystyna Gorniak- Kocikowska, who believes that "computer ethics is the most important theoretical development in ethics since the Enlightenment"[20].

The Innovative approach: Information Ethics as the Foundation of computer-Ethics

The innovative approach proposed by Bynum takes a different course and removes all weaknesses of conservative or radicle approaches. Floridi et al argued that "[computer ethics] problems, the corresponding policy and conceptual vacuum, the uniqueness debate and the difficulties encountered by RA and CA in developing a cohesive metaethical approach strongly suggest that the monopoly exercised by standard macroethics in theoretical CE is unjustified"[20]. Floridi et al believed that computer ethics problems "not only adds interesting new dimensions to old problems, but leads us to rethink, methodologically, the very grounds on which our ethical positions are based. Although the novelty of CE is not so dramatic as to require the development of an utterly new, separate and unrelated discipline, it certainly shows the limits of traditional approaches to the ethical discourse, and encourages a fruitful modification in the metatheoretical perspective"[20].They further argued that innovative approach is neither like conservative approach which allow classical ethical theories to be applied for computer ethics, nor like radical approach which considers computer ethics as unique and independent of classical theories, rather innovative approach "argues that theoretical CE should be promoted to the level of another macroethics because it does have something distinctive and substantial to say on moral problems, and hence can enrich the metaethical discourse with a new and interesting approach of unquestionable philosophical value"[20]. Floridi et al proposed for this Information Ethics defined by them as "the theoretical foundation of applied CE, is a non-standard, environmental macroethics, patient-oriented and ontocentric, based on the concepts of information object/infosphere/ entropy rather than life/ecosystem/pain"[20]. Information Ethics is proposed by Floridi for foundation of computer ethics. Before information ethics computer ethics work was anthropomorphic and based on classical theories such as utilitarianism, contractualism, Kantianism, or virtue ethics, Information ethics widened the territory of computer ethics and went beyond anthropomorphic concepts and complemented the traditional ethical theories to cater all ethical situations which are beyond the scope of macroethics[19].

Information ethics which removes many weaknesses of previous theories is still not a perfect theory to apply for computer ethics as Floridi et al states that Information ethics "is not immediately useful to solve specific CE problems but

it provides the conceptual grounds that can guide problem-solving procedures in [computer ethics]. Through [information ethics], [computer ethics] can develop its own methodological foundation, and hence support autonomous theoretical analyses of domain-specific issues, including pressing practical problems, which in turn can be used to test its methodology"[20]. Rafael Capurro suggested "that a weakening of Floridi's demiurgic information ecology is needed in order not to forget the limitations of human actors and/or of their surrogates, digital agents. I plea for a rational theoretical and practical view of such agents beyond utopian reasoning with regard to their potential moral status"[28].

IV. COMPUTER ETHICS DOMAIN OF COMPUTER SCIENTIST

Computing technologies and artifacts are so pervasive that they have gone deep in our lives and have become part of us and our society. The pertinent ethical issues generated by this pervasive technology have grown so radically and are overwhelming, thus it is sine qua non to give it a moral framework. Even though huge research work is done in the field, as is prevalent from above discussion, but still there is no clear consensus among communities of technical scholars and practitioners regarding the conceptual framework for computer ethics. All theories proposed till now for computer ethics are not catering to the requirements of computer ethics and fail to provide proper foundational framework. There is still work needed to be done on conceptualization of computer ethics and also on practical side of computer ethics which is a preventive measure of computer ethics i.e. professionalism. The professional ethics can act as preventive measure for computer ethics issues, as it directly deals with such issues. Professional ethics as proposed by Gotterbarn is for computing professionals devoted to the improvement and advancement of ethics of good practice and codes of conduct ,as he said "--the values that guide the day to day activities of computing professionals in their role as professionals. By 'computing professional' I mean anyone involved in the design and development of computer artifacts. Computer artifacts include things like: program documentation, test plans and test cases, feasibility studies, source code, user manuals, system maintenance manuals and design documents that is, all the products of the system development process. The ethical decisions made during the development of these artifacts have a direct relationship to many of those issues discussed in computer ethics textbooks. I believe many of those issues are the result of bad computer ethical decisions made during software development"[29]. Gotterbarn argued "The only way to make sense of Computer Ethics is to narrow its focus to those actions that are within the horizon of control of the individual MORAL computer professional. Narrowing the domain of computer ethics in this way, does not lessen the significance of those topics that have been mistakenly included as issues as computer ethics. I believe that such a correction will make the resolution of those broader issues easier. Those issues will no longer suffer from the red herring that they cannot be solved because as issues in computer ethics they require some yet to be determined new type of ethics and a new type of ethical reasoning"[22]. Gotterbarn argued that computer ethics is like business ethics, medical ethics or engineering ethics. The professional ethics is to create professionals with ethical bent of mind and morality at their core. Gotterbarn further suggested that "in applied professional ethics courses, our aim is not the acquaintance with complex ethical theories, rather it is recognising the role responsibility and awareness of the nature of the profession"[22]. Thus computer ethics is not the job of philosophers but computer scientists, as philosophers are qualified in ethical theories but they have no technical expertise pertinent to computer science. Deborah Johnson believes that many issues which are related with computer ethics like intellectual property and privacy may become part of ordinary ethics and thus computer ethics as a field of its own of applied ethics may stop to exist[30]. If Johnson's prediction come true, still professional ethics will be needed as a field that scrutinizes moral issues affecting responsibility for computing professionals.

Computer scientist has to work on many fronts to apply professional ethics and has to work for development and improvement of professional responsibility among computer practitioners. The list is long, few are discussed as:

Code of Ethics and Professional Practice

Every professional organization has a code of ethics that documents the moral and professional accountabilities and duties of computing professionals. For example IEEE CS/ACM Code of Ethics and Professional Practice upon which industrial decisions, professional certification, and educational curricula can be based. The Association for Computing Machinery's Committee on Professional Ethics (COPE) is calling computer scientists to build the Code 2018 Task Force and accomplish three projects up to 2018: Updating ACM's Code of Ethics and Professional Conduct, revising the enforcement procedures for the Code, and developing new media to promote integrity in the profession[31]. Computer scientist has a job to build a versatile code of ethics, as it is the life line of professional practices.

Integrating ethics in computer science curriculum

Computer science programs must establish that their students have an understanding of ethical and professional responsibility. The Accreditation Board of Engineering and Technology (ABET) states that "engineering programs must demonstrate that their graduates have an understanding of professional and ethical responsibility"[32]. The Association for Computing Machinery (ACM) and the Computer Society of the Institute for Electronics and Electrical Engineers (IEEE-CS), in 1991 published Computing Curricula 1991, which suggested that:

Undergraduates also need to understand the basic cultural, social, legal, and ethical issues inherent in the discipline of computing…Students also need to develop the ability to ask serious questions about the social impact of computing and to evaluate proposed answers to those questions. Future practitioners must be able to anticipate the impact of introducing a given product into a given environment. Will that product enhance or degrade the quality of life? What will the impact be upon individuals, groups, and institutions?... Future practitioners must understand the responsibility that they will bear, and the possible consequences of failure…To provide this level of awareness, undergraduate programs should devote explicit curricular time to the study of social and professional issues.[33]

In 1994, the National Science Foundation funded a 3-year Project on the Integration of Ethics and Social Impact within the Computer Science Curriculum. In 1998 commenced another major review of curriculum guidelines for undergraduate programs in computing, Computing Curricula 2001 (CC2001) [34]. There is a debate in literature as to who should teach computer ethics: Should it be taught by a computer scientist or a philosopher. We believe that it should be taught by a computer scientist. We suggest computer ethics should not be taught like a separate subject or case based or example based, rather it should be integrated across curriculum in such manner that computer ethics becomes as rigorous as computer science itself. It is the job of computer scientist to merge ethics and computer science as one entity, such that ordinary computer science problems will be taken as ethical problem. This can be done only by a computer scientist who is trained in computer science.

Software Engineering Ethics

Software engineering is an engineering discipline that is concerned with theories, methods and tools and deals with all phases of professional software development. Software development is a powerful entity which drives economies of nations and has become a life line of modern societies. Software's are critical to society and are used across all departments of society e.g. applications used in health, financial, library, legal, personnel, defense, education, transportation and many other systems which drive our society. Software engineering is not just application of technical skills but implicates extensive accountabilities. Software engineers as a professionals have a much broader ethical responsibility more than simply safeguarding the law. Software has a direct and critical social implications, so with technical proficiency, the worth of software products depend on the ethics and professional conduct of the engineers that develop them. Software engineering as a discipline and profession is relatively in its infancy and lot of work as a computer scientist need to be done for establishing software engineering as a profession.

IV. CONCLUSION

This article explored the development of computer ethics and has suggested that neither traditional ethical theories nor foundational ethical theories are perfect for computer ethics. This article suggested that Professional approach is more suitable and emphasized that this approach is practical for computer ethics. It has been shown that work is needed to be done by computer scientist in many areas like , to build a better professional code of ethics, to integrated computer ethics into computer science curriculum such that technology and ethics merge into a single entity and also to build better standards for software development. The authors of this article emphasizes that it is the job of computer scientist to apply professional ethics for computer ethics.

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